Samira Malek

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Education

Pennsylvania State University — **Pennsylvania, USA**
Ph.D. in Computer Science & Engineering — *2023–present*

Pennsylvania State University — **Pennsylvania, USA**
M.S. in Computer Science & Engineering — *2023–2025*

Sharif University of Technology — **Tehran, Iran**
M.S. in Electrical Engineering — *2018–2020*

Sharif University of Technology — **Tehran, Iran**
B.S. in Electrical Engineering — *2013–2018*

Research Interests

- Natural Language Processing
- Computational Imaging
- Communication
- Computer Vision
- Learning Theory
- Information Theory
- Optimization
- Explainable Deep Learning
- Signal Processing

Honors and Awards

- Awarded the College of Engineering Dean's Office scholarship at **Pennsylvania State University**. *2022*
- **Ranked 29th** in the Iran Nation-wide University Entrance Exam (Konkoor) for M.S degree, among **+40,000** test-takers. *2018*
- **Ranked 40th** in the Iran Nation-wide University Entrance Exam (Konkoor) for B.S degree, among **+84,000** test-takers. *2013*
- **Silver Medalist** of 30th Iran National Mathematical Olympiad. *2012*
- Admission to high school in **National Organization for Development of Exceptional Talents (NODET)** (success rate $<$ **0.3%**). *2009*

Research Experience

Pennsylvania State University — **Pennsylvania, USA**
Ph.D. Thesis — *2023–present*
- Designing generalizable and explainable deep neural networks for image restoration tasks such as denoising and deblurring.
- Establishing theoretical guarantees of convergence for both the full network and its component blocks.

Sharif University of Technology — **Tehran, Iran**
M.S. Thesis — *2018–2021*
- Designed novel neural network decoders (MVN, MatNet) inspired by belief propagation.
- Improved decoding accuracy (lower BER) on BCH, LDPC, and Polar codes.
- Reduced computational complexity by up to 98% compared to prior state-of-the-art methods.

Sharif University of Technology — **Tehran, Iran**
B.S. Thesis — *2016–2017*
- Analyzed recorded MicroElectroRetinoGram (MERG) signals from mice to study neural retina responses.
- Developed denoising and classification methods to differentiate healthy and unhealthy retinas.

Work Experience

Applied Research Laboratory, Pennsylvania State University — **Pennsylvania, USA**
Research Assistant — *2024–2025*
- Developed a methodology powered by Large Language Models (LLMs) to detect health-related misinformation (both human-created and AI-generated) on social media.
- Designed a hierarchical topic modeling framework to analyze misinformation and generate sentence-level topic descriptions.
- Built a refutation generation module to explain inaccuracies and provide corrective responses with actionable guidance.
- Applied the framework to datasets of COVID-19 and HPV vaccine misinformation, producing interpretable analyses.

SNOWA **Tehran, Iran**
Data Scientist *2022*
Contributed as a Data Scientist in the Customer Relationship Management (CRM) department of SNOWA, a leading home appliance manufacturer in Iran. Key projects included:
- Developed customer segmentation using unsupervised learning (e.g., K-means) to support targeted marketing.
- Applied graph-based algorithms in SQL to identify and analyze customer relationship networks.
- Designed and developed a scalable Data Warehouse to support business intelligence and analytics.

Grants & Funding

- Financial assistance award from the Economic Development Administration Build Back Better Regional Challenge, Farms Food Future (F3) Innovation.
- Partial support from NSF and AgAID Institute (Agricultural AI for Transforming Workforce and Decision Support) under the USDA-NIFA award No. 2021-67021-35344.
- Research grant from the Investigator Initiated Studies Program of Merck Sharp & Dohme Corp (MISP #102050).

Publications

- Hamed Mahdavi, Alireza Hashemi, Majid Daliri, Pegah Mohammadipour, Alireza Farhadi, **Samira Malek**, et al. **"Brains vs. bytes: Evaluating llm proficiency in Olympiad mathematics"**, Conference On Language Modeling, 2025.
- **Samira Malek**, et al. **"A Methodology Framework for Analyzing Health Misinformation to Develop Inoculation Intervention Using Large Language Models: A case study on covid-19"**, submitted to Journal of Medical Internet Research, 2025.
- **Samira Malek**, et al. **"A Large Language Model-Based Analyzing of HPV and COVID-19 Vaccines Misinformation on Social Media"**, submitted to Health Informatics Journal, 2025.
- **Samira Malek**, et al. **"Cascaded, Convergent Unrolled Deep Neural Networks for Blind Image Deconvolution"**, submitted to IEEE Transactions on Computational Imaging, 2025.
- Mohsen Farajijalal, **Samira Malek**, et al., **"Data-Driven Model to Improve Mechanical Harvesters for Nut Trees"**, ASABE Annual International Meeting, 2024.
- **Samira Malek**, et al., **"Multi Variable-layer Neural Networks for Decoding Linear Codes"**, Iran Workshop on Communication and Information Theory (IWCIT), IEEE, 2020.
- **Samira Malek**, et al., **"A Deep Neural Network Architecture for Decoding Linear Codes Based on the Parity Check Matrix"**, (it's available here).

Teaching Experience

- **TA for Discrete Mathematics** in Pennsylvania State University. *Spring & Fall 2023, Spring 2024*
- **TA for Signal & System** in Sharif University of Technology. *Fall 2019*
- **TA for Stochastic Random Process** in Sharif University of Technology. *Spring 2019*
- **TA & MATLAB Teaching for Engineering Mathematics** in Sharif University of Technology. *Spring 2019*
- **Design Mock Test** of the Iran Nation-wide University Entrance Exam (Konkoor) for B.S degree in Kanoon Institution, which has the most participants in Iran (more than +20,000 students every year). *2017–2018*
- **Teaching Mathematics** Farzanegan High school (NODET), Preparing students for Iran National Mathematical Olympiad. *2014–2015*

Selected Courses

- Deep Learning for NLP
- Convex Optimization
- Pattern Recognition & ML
- Probability and Statistics
- Communication Systems
- Large Scale Machine Learning
- Non-convex Optimization
- Secure & Robust ML
- Stochastic Random Process
- Digital Signal Processing
- Machine Learning Algs & Tools
- Distributed Optimization
- AI and Biological Computation
- Speech Processing
- Image Processing

Selected Academic Projects

Deep Learning

Fallacy Science Question Answering with LLMs *Fall 2024*

- *Built dataset of fallacy-based science questions; evaluated Llama, Gemini, and ChatGPT, improving model accuracy on reasoning by 60% through optimized prompts.*

Identifying the Source Model of Generated Text *Fall 2024*
- *Generated datasets using five large language models and trained BERT classifiers to distinguish text by source model.*

Multi-hop Question Answering with GPT *Spring 2023*
- *Trained GPT models via prompting for multi-hop reasoning on the HotPotQA benchmark.*

Pitch Tracking in Noisy Speech *Spring 2019*
- *Implemented feedforward and recurrent neural networks for pitch estimation in noisy conditions.*

EEG-based Typing Classification *Spring 2016*
- *Designed a neural network to classify right- vs. left-handed typing using EEG signals.*

Backdoor Attack and Detection on CIFAR-10 *Spring 2024*
- *Designed and evaluated additive backdoor attacks and implemented detection methods for image classifiers.*

Optimization

MinMax Optimization Algorithms *Spring 2023*
- *Implemented Stochastic Gradient Descent Ascent (SGDA) and Stochastic Compositional Gradient (SCSC) for min-max optimization problems.*

Classical Optimization Methods *Fall 2018*
- *Implemented BFGS, Steepest Descent, and Newton's method with line-search for nonlinear optimization.*

Signal Processing & Communications

Viterbi Algorithm and Sequence Detection *Spring 2020*
- *Implemented the Viterbi algorithm and developed a reduced-complexity sequence detector for communication systems.*

Pitch Contour Extraction *Spring 2019*
- *Extracted pitch contours from speech signals using SIFT, HPS, and AMDF algorithms.*

Image Recovery via Sparse Methods *Fall 2018*
- *Applied IMAT and OMP algorithms for image recovery from incomplete data.*

Signal Reconstruction Techniques *Fall 2018*
- *Reconstructed 1-D and 2-D signals using SDFT and RS methods.*

Computer Skills

Programming Languages: Python, MATLAB, SQL, C/C++, LaTeX, html

Software: VScode, Anaconda, Microsoft Power BI, Microsoft SQL Server Management Studio

Languages

- English
- Persian
- Azerbaijani